

many differences in structural joinery depending upon the time and place where they were used. Such construction details help us understand building practises, and they also help us understand their structural performance, especially when they have become overloaded or damaged with the intrusion of modern utilities or insects or fungus.

This butt hinge (figure 2) is from the Bishop White House built 1787 in Philadelphia. The Bishop White House hardware is interesting as an example of the "hierarchical quality" approach often used in early buildings. As applied to the Bishop's house, this approach meant that the best rooms on the first and second floors had dovetail hinges that were set into a mortise in the back edge of the door and held in place with wooden wedges, so that only the knuckles could be seen and thus were "semi-secret," as opposed to earlier face mounted H and HL hinges. The third floor doors had the then new cast-iron butt hinges and the attic doors had the "old fashioned" HL hinges.

The butt hinge seen here is known to be original to a closet door on the third floor (by virtue of the screw holes), though the door itself had been moved to another location. The hinge was broken and could not be used when the door was to be relocated to its original location. Thus, the wooden pattern (seen here on the right) was made for casting a new hinge to replace this broken original.

Little research has been done on butt hinges, as perhaps they have never captured the interest or imagination of preservation historians. At the time of building the Bishop White House, butt hinges were relatively new, and it is likely that they were part of a hardware order that the Bishop placed with a London merchant. Both the dovetail hinges and the "Cast Butts" were illustrated in an untitled English hardware catalog thought to have been printed in the 1780s. One such catalog reputedly was owned by Benjamin Franklin and which Franklin may have used when his own house was being built on lower Market Street in the late 1780s.

The hinge seen here has the word "PATENT" cast into one of the leaves. We assume that this refers to an English patent, but more



Fig. 2. Cast-iron "PATENT" butt hinge (INHP Acc. No. 2375, no. 2). Photo by the author.

research needs to be done on this subject. In fact, many such items of hardware used in early buildings need to have more research done before we will really understand their invention, development, and use in American buildings. Items in architectural study collections are good candidates for research by graduate students in historic preservation. Recommended starting points would be an article by Donald Streeter on the subject of hinges in the *APT Bulletin*, Vol. V, No.1, 1973, pp. 22-49, and a brief essay on early hardware catalogs written by this writer as an introduction to the *Russell and Erwin Hardware Catalog of 1865*, reprinted by the APT in 1980.

Lee H. Nelson, FAIA, who retired from the National Park Service in 1990, is currently completing a project to document stone repair at the White House. He has also been hard at work on a study of early trusses.

## An Engineer

Engineers examine, evaluate, and determine the structural integrity of historic structures. Their role is essential and yet they are frequently underrepresented in the preservation community. Objects from architectural study collections provide invaluable information to their ongoing work and, as is true for all people interested in historic structures, offer much from which to learn.

## Uses of Structural Artifacts in an Engineering Office

Robert Silman

The standard engineering school curriculum in our colleges does not teach the history and development of structural systems. Engineering schools prefer to concentrate on the current state of the art and what the future will hold. Very few engineers enroll in historic preservation programs or courses. Therefore, the only way in which engineers can learn how to restore and rehabilitate older buildings with a proper sensitivity and respect for the original fabric of the structure is to gain experience on the job.

There is no substitute for going out on a site and observing conditions first-hand. However, we often would like to prepare an untrained engineer for what he or she might expect to encounter at the site. For these purposes, an office archive of photographs and artifacts is invaluable. If the inexperienced engineer can be shown visually what to anticipate, or better yet can touch it, the site visit will be infinitely more meaningful.

Our office has collected structural artifacts from many buildings. These are useful for several reasons:

- They illustrate structural systems no longer in use;
- They demonstrate potential modes of failure;
- They indicate how a repair may be effectively executed.

Our collection includes anchors, fasteners, ties, hangers, connectors, inserts, reinforcing bars, brick, tile, stone, concrete plaster, lath, wood, engineered wood products, adhesives, structural fabric, corroded beams, and columns.

Two examples of the use of the collection will be cited. During the restoration of Carnegie Hall (New York City, 1987) it was determined that much of the structural steel framing (beams and columns) was located too close to the exterior face of the brick facade to provide for proper weather protection. Because the brick had not been pointed for many years and because the joints were open, water had been driven in and caused the steel to corrode. At many locations the outer half of one flange and the entire web was severely corroded while the inner half of the flange was totally intact. In subsequent projects when evidence is present which indicates a similar condition, we use the fragment of beam shown in figure 1 to alert the engineer to a condition which might be encountered. Since most of these conditions are initially concealed and since extensive physical probes destroy too much original fabric, being able to anticipate the condition of corrosion is extremely useful.

A second example which is often encountered deals with buildings constructed of timber floors and brick bearing walls, usually more than 75 years old. We are often asked to evaluate the stability of the brick walls, particularly if the original mortar (often a soft lime mortar) is deteriorated.

(Engineer—continued on page 22)

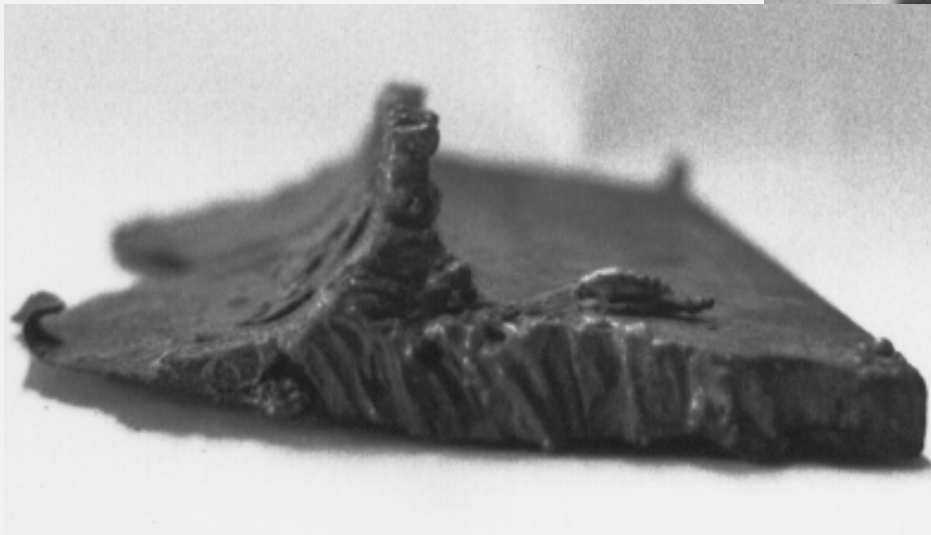


Fig. 1. Two views of a steel flange (c. 1891) from the structural framing at Carnegie Hall. Flange displays a fully corroded surface at one end and a non-corroded surface at the other. Photo by Marie Ennis, P.E., courtesy of Robert Silman Associates files.

The walls are braced by means of connections made to the wood floor joists with iron or steel anchors set either parallel or perpendicular to the joists. Figure 2 illustrates three types of brick anchors in which one end is embedded in the masonry while the free end is nailed to the floor joists. By seeing these anchors in advance, the engineer is better prepared to conduct a field survey and may be able to minimize probes. For instance, a fiber optic borescope may be inserted into a small hole in the plaster ceiling and the observed image of a wall anchor compared with our collection of samples; the field of vision being limited with fiber optics, sometimes the images are difficult to identify.

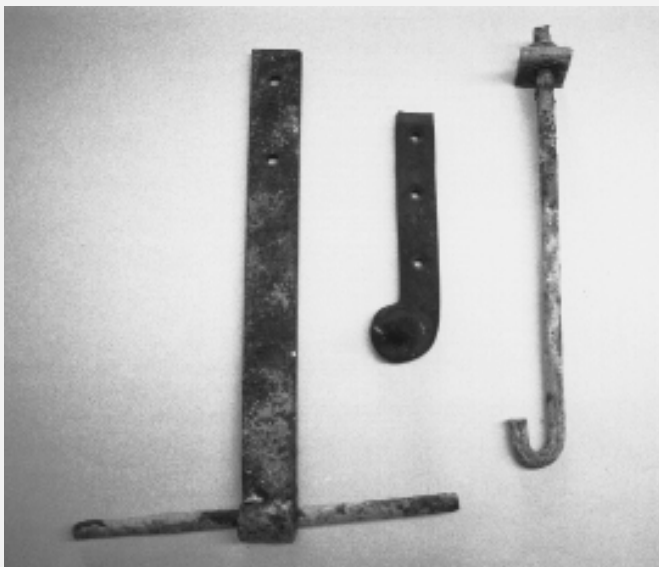


Fig. 2. Brick anchors made of iron, from left to right:  
1. c. 1879, from 105 Greene St., New York, NY (Soho). Cast-iron facade from a light manufacturing building designed by Henry Fernbach.  
2. c. 1880, from 7th Regiment Armory, Park Avenue between 66th and 67th, designed by Charles W. Clinton.  
3. c. 1927, from Brooklyn General Post Office, 271 Cadman Plaza, Brooklyn, NY. Post Office built c. 1885-1891, designed by Mifflin. New addition built 1927, designed by James Wetmore. Photo by Marie Ennis, P.E., courtesy of Robert Silman Associates files.

Some other useful collection artifacts include:

- Reinforcing bars and mesh from early patented reinforced concrete systems;
- Terra cotta castings, both new and old, both intact and failed, including the attachment hangers and hardware;
- Timber beam and girder hangers including heavy duty bridle irons and skewed beam saddles;
- Types of clay and terra cotta tiles.

The convenience of an in-house collection is unquestionable. Although collections at other locations are of course excellent resources, office professionals are always striving to build up the office's assemblage of structural artifacts.

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